

## **BENEFITS OF MANAGEMENT ACTIONS FOR NEARSHORE ZONE**

### **OVERVIEW OF WATER QUALITY ISSUES AND MANAGEMENT GOALS**

Within the nearshore zone, water quality issues include, but are not limited to:

- control of excessive periphyton growth,
- control of excessive growth of aquatic macrophytes,
- reduction of bacterial contamination, protection of drinking water withdrawn from the lake,
- stabilization of heavy metals, and lake level fluctuations.

The designated beneficial uses include domestic water supply, agricultural water supply, cold water biota, salmonid spawning, primary contact recreation, and secondary contact recreation. The water quality conditions measured during the 1991-93 lake study indicate these beneficial uses are not fully supported, because of aquatic biota criteria are exceeded for zinc. Impact to aquatic biota has been demonstrated only in the case of phytoplankton growth inhibition. Drinking water standards which are enforced at the tap are being met in the raw water.

In the past few years, there has been a major increase in the conversion to residential use of lands adjacent to the lake. The nearshore population has also increased rapidly, not only as new residences are built, but as existing residences are converted from seasonal to year

round usage. This recent development of the nearshore area may be detrimental to the recent trend of improved lake water quality because the conversion of an acre of forest land to urban use can increase phosphorus runoff by a factor of 5 to 20 times (U.S. Environmental Protection Agency, 1990).

Another impact on lake water quality is from leachates from nearshore septic tank systems. Older systems most likely contribute more nutrients to lakes than new system and may continue to leach nutrients for many years after abandonment. The actual effects of these systems on nearshore water quality can only be assessed after additional study because the scope of the 1991-93 lake study precluded an in-depth evaluation. Upgrade costs may be substantial. Thus, the benefits to nearshore water quality will need to be accurately assessed to determine the relation of costs to benefits. A comprehensive assessment of nearshore sewage disposal requirements and plans is probably warranted (similar to that being conducted on the Spokane River). The question of whether or not new growth should bear the cost of upgrading old septic tank systems, based on the concept of pollution trading, needs to be addressed.

The majority of public comments during the April 1994 public meetings favored a goal of "slow improvement" for the nearshore zone instead of the alternative goal of "rapid improvement." The goals of "no action" and "maintain current conditions" were not legally viable because of violations of water quality criteria and standards.

If no actions were taken, then water quality likely would deteriorate further, especially in nearshore areas receiving increased sediment and nutrient runoff from intensive

Table 30. Management actions recommended by rivers technical advisory group.

Bank Erosion/Stabilization Actions		Priority	Lead Agency(s)	Estimated Cost	Funding Source
<b>Goal:</b> Reduce accelerated stream bank erosion on the lower St. Joe by 25% and Coeur d'Alene River by 50% over the next decade.					
Action 1: Inventory rapidly and moderately eroding banks in the slackwater reaches of the Coeur d'Alene (CdA) and St. Joe banks.		1	DEQ USGS	minimal	Current monitoring resources
Action 2: Develop an informational pamphlet for distribution to boat registrants education them on the damage caused by boat wakes to river banks.		1	CBRP	\$2,500	CBRP Public Education Budget
Action 3: Develop and support legislation enabling counties to assess user fees dedicated to lake protection activities including bank stabilization.		1	CBRP, CAC, local legislators	minimal	CBRP mechanism counties
Action 4: Develop a standardized and cost efficient bank stabilization method for eroding Coeur d'Alene River banks.		1	ACOE, IDWR, IDL, DEQ, IDFG, USF&WS	minimal	Agency budgets
Action 5: Develop a log or tree revegetation demonstration project for undeveloped banks of the St. Joe River. Log or tree revegetations are logs or trees placed and anchored under an undercut bank to absorb the wave energy and resist further bank undercutting.		1	CBRP Cooperating agencies	\$8,000	CBRP, DEQ, EPA
Action 6: Armor and vegetate rapidly eroding banks as budget allows according to priorities of Rivers TAG (list). Priorities will be established after the bank erosion inventory is completed.		1	ACOE, IDL, IDWR, IDFG, & DEQ	\$1,000,000±	Federal Grants State WPCA Users Fees counties
Action 7: Develop support for public land managers (IDFG, IDL, USFS, BLM) to implement bank stabilization on the public lands. Armor banks at all existing recreation sites and any new sites developed.		1	CBRP, CAC	minimal	CBRP mechanisms

<p>Action 8: Identify sources of trace (heavy) metal loads in the CdA River between Cataldo and Harrison with special attention to:</p> <ul style="list-style-type: none"> <li>a) Need for tailings removal from banks or channel</li> <li>b) Advantage of stabilizing water levels in the river or its wetlands.</li> <li>c) Assess if bank stabilization will be effective in curtailing metals loading.</li> <li>d) Monitoring of the bank erosion rate.</li> </ul>	2	USGS, NRDA, Trustees, DEQ, CBRP, WWP	\$75,000	Federal grants State WPCA
--	---	--------------------------------------	----------	---------------------------------

Bank Stabilization Permit Actions	Priority	Lead Agency(s)	Estimated Cost	Funding Source
<p><b>Goal:</b> Educate private landowners and governmental managers engaged in bank stabilization on the St. Joe and Coeur d'Alene Rivers on the nationwide permit available, stabilization guidelines and suggested approaches.</p> <p><b>Action 1:</b> Develop a pamphlet explaining the Army Corp of Engineers bank stabilization permit, stabilization design features and recommendations on methods to develop beach and wildlife areas.</p>	1	ACOE, IDWR, IDL, DEQ, IDFG, USF & WS	\$2,500	CBRP mechanism

development. In order to maintain current conditions, measures would need to be implemented to reduce sediment and nutrient runoff from existing and new development.

If the goal of "rapid improvement" had been chosen, then an aggressive program of BMPs and ordinances would be necessary, especially in nearshore areas already exhibiting serious water quality problems such as Kid Island Bay. In such cases, it would be advisable to form watershed "forums" to address the specific water quality issues and how best to deal with them.

#### WATER QUALITY MANAGEMENT GOAL: IMPROVE SLOWLY

The goal of "slow improvement" in the nearshore zone is to be achieved with management actions developed by the TAGs for forest practices (table 22), agriculture (table 23), and development (tables 24-27). The development TAG presented its management actions under four categories: stormwater (table 24), roads (table 25), wastewater (table 26), and miscellaneous topics (table 27).

The water quality impacts on the nearshore zone largely emanated from the addition of sediment and associated nutrients eroded from small watersheds that border the lake. Therefore, the majority of management actions for the nearshore zone are aimed at erosion control within those small watersheds; addressed primarily with management actions for stormwater (table 24), roads (table 25), and agriculture (table 23). Water quality in the nearshore zone is also affected by nutrient loadings delivered to the lake by the Coeur d'Alene and St. Joe Rivers. Management actions for erosion control within these two

large watersheds are listed under forest practices (table 22) and agriculture (table 23).

Nutrients contained in wastewater also affect water quality in the nearshore zone. Management actions for wastewater (table 26) deal with discharges from nearshore domestic sources as well as municipal wastewater treatment plants on the Coeur d'Alene and St. Joe Rivers. Reductions in nutrient loadings from nearshore domestic sources could be achieved through a combination of actions: upgrading or replacement of older septic tank systems, improved maintenance and inspections, public education, and a ban on phosphate detergents. For municipal systems, the total maximum daily load (TMDL) process would be used to evaluate the efficacy of nutrient load reductions, with an early emphasis on the treatment plant at Page. Upgrades of domestic and/or municipal systems might be funded in part via pollution trading and/or credits whereby new sources of nutrient loadings may mitigate their impact by funding equivalent reductions from existing loading sources.

The 1991-93 lake study identified the nearshore areas of the following bays as having abundant growths of aquatic macrophytes: Carey, Carlin, Cougar, Kid Island, Loffs, Mica, Powderhorn, Rockford, 16 to 1, Windy, and Wolf Lodge Bay (eastern end). The plant biomass could be harvested periodically with mechanical harvesting equipment, in cases where macrophytes interfere with aesthetics and boat traffic. This management action and its environmental considerations are discussed in more detail in a later section on the shallow, southern lake zone.

The foregoing discussion of management

actions dealt with nutrients and biological production; however, the nearshore zone also suffers from zinc concentrations that exceed federal water quality criteria. The reduction of zinc concentrations in this zone will be largely dependent on activities conducted within the Coeur d'Alene River Basin. With this management plan are management actions geared to reduce erosion of zinc-bearing sediments in the lower reaches of the Coeur d'Alene River. The ongoing cleanup of the Bunker Hill Superfund Site should result in reduced loadings of zinc to the lake. The Coeur d'Alene Basin Restoration Project has planned numerous mining-related remediation projects within the South Fork Coeur d'Alene River. These should also reduce zinc loadings to the lake.

The management actions for the nearshore zone are intended to attain, within the next decade, the desired water quality conditions for concentrations of dissolved oxygen, total phosphorus, and zinc, clarity, and coliform bacteria counts listed in Table 31. Table 31 compares the desired conditions to those measured during the 1991-93 lake study and any applicable legal-based standards. For dissolved oxygen concentration and clarity, the current conditions have already attained the desired condition. Current concentrations of total phosphorus and zinc exceed the desired condition.

## **BENEFITS OF MANAGEMENT ACTIONS FOR SHALLOW, SOUTHERN LAKE ZONE**

### **OVERVIEW OF WATER QUALITY ISSUES AND MANAGEMENT GOALS**

Within the shallow, southern lake zone, water quality issues include, but are not limited to:

- reversing the depletion of dissolved oxygen,
- stabilization of highly enriched heavy metals in the lakebed,
- potential toxicity of heavy metals to aquatic biota in the lakebed and lake water,
- control of sedimentation,
- improvement of water clarity, and
- control excessive growth of aquatic plants.

The heavy metal concerns are restricted to the area north of Conkling Point.

The designated beneficial uses include domestic water supply, agricultural water supply, cold water biota, salmonid spawning, primary contact recreation, and secondary contact recreation. The water quality conditions measured in the shallow, southern lake zone during the 1991-93 lake study indicate the beneficial use for cold water biota is not supported during the warm months because dissolved oxygen is well below 6 milligrams per liter during the summer. The federal water quality criteria

Table 31      Numeric Values for current, desired, and criteria/standards-based water-quality conditions in the deep, nearshore management zone.

	Desired Condition <sup>11</sup>	Current Condition <sup>1</sup>	Standard or Recommended Level <sup>10</sup>
Dissolved Oxygen (mg/L) <sup>2</sup>	8.6	8.6	6.0 <sup>3</sup>
Total P (ug/L)(ppb) <sup>2</sup>	5-10	5.0 <sup>8</sup>	25.0
Zinc(ug/L)(ppb) <sup>2</sup>	32.7	56	32.7
Clarity (Secchi depth meters)	7.6	7.6 <sup>4</sup>	none
Coliform bacteria	500/100 ml	-	500/100 ml <sup>5</sup>
	200/100 ml	-	200/100 ml <sup>6</sup>
	50/100 ml	-	50/100 ml <sup>7</sup>

1. Average condition of 19 bays unless otherwise noted.
2. Seven day average.
3. Standard applies to all waters except the lowest 7 meters of the water column at depths greater than 35 meters.
4. Average of 19 bays 7.6 meters; worst case Fuller's 5.2 meters.
5. At any time.
6. In no more than 10% of the samples taken over a 30 day period.
7. Geometric mean of samples taken over a 30 day period.
8. Average total phosphorus for 19 bays over two years; worst case, Kidd Island Bay, 16 ug/L.
9. Average of 19 bays; worst case Kidd Island Bay, 150/100ml.
10. Standard based Idaho Water Quality Standards and waste water treatment requirements, EPA "Gold Book" criteria (as interpreted by National Toxic Rule) or phosphorus levels recommended to prohibit nuisance aquatic weed growth.
11. Based on interpretation of Idaho Antidegradation policy and special resource waters designation of lake Coeur d'Alene.

are not met because of potential toxicity of zinc to aquatic biota.

This lake zone receives inflow from the St. Joe River and several small watersheds with significant agricultural development, such as Plummer and Benewah Creeks. The influence of the St. Joe River is muted within Chatcolet, Benewah, and Round Lakes because levees channel its flow nearly to Conkling Point. The major water quality problem in the Plummer Creek drainage is nutrient and sediment loading from non-irrigated agricultural and silvicultural activities conducted on highly erodible lands. Plummer Creek also receives runoff from urban and industrial areas, a confined hog operation, and other livestock grazing. The wastewater treatment plant for the city of Plummer is also in the drainage. Past and present land management activities in the drainage have produced significant adverse effects on receiving lake waters (Benewah Soil and Water Conservation District, 1990). Benewah Creek has similar water quality problems, but to a lesser extent than Plummer Creek.

This zone of the lake is different from the other three because in-lake processes are important determinants of biological production. When Post Falls Dam raised the lake level in 1906, the extensive wetlands in this zone became lakes. Their lakebeds were formerly fertile wetland and marshy soils. The lakebeds have been further enriched by the annual die-off of aquatic plants that inhabit a large percentage of this zone's area. Nutrients are released from the lakebed sediments. When dissolved oxygen is depleted, sometimes completely, it creates reducing conditions within the lakebed, which greatly increase the rate of release. This process is

termed "internal fertilization" and usually requires in-lake remediation techniques to circumvent it. The aquatic plants also add nutrients to the lake via "nutrient pumping" when, during their growing season, they obtain nutrients from the lakebed and subsequently release nutrients into the lake water through their tissues. The shallowness of these lakes can also allow resuspension of lakebed sediments by wind-induced or boat-induced turbulence.

The aquatic plants play an important role in the water quality problems in this zone. However, their presence is not totally negative. Wild rice has become so abundant in Benewah Lake that it is commercially harvested. Excessive plant growth is also occurring in Round Lake where commercial wild rice harvest has also been proposed. Although shallow open-water areas are being overgrown by aquatic plants, additional waterfowl and fishery habitat is being gained. The aquatic plant beds are important nursery areas for young-of-the-year fish. Remediation techniques affecting these plants should consider the potentially negative effects on fishery production.

The majority of public comments during the April 1994 public meetings favored a goal of "slow improvement" for the shallow, southern lake zone instead of the alternative goal of "rapid improvement." The goals of "no action" and "maintain current conditions" were not legally viable because of violations of water quality criteria and standards.

If no actions were taken to improve water quality, then water quality problems would worsen, particularly in the areas with excessive aquatic plants. Sedimentation

would worsen via two processes: trapping of inflowing sediment by aquatic plants and buildup of dead plants on the lakebed. Dissolved oxygen depletion would worsen as the organic and nutrient content of the lakebed sediments was increased by sedimentation from the watershed and annual die-off of aquatic plants. Given enough time, the shallow lake areas will revert to wetlands.

In order to maintain current conditions, sediment and nutrient loads from the watershed would need to be reduced to counter the stimulatory effects of increasing aquatic plant growth. Plant growth rates would be unlikely to respond to reduced external nutrient loads because they derive much of their nutrient input from the lakebed sediments. Therefore, limited harvesting of aquatic plants could be employed to reduce the accrual of organic matter to the lakebed.

If the goal of "rapid improvement" had been selected, then the watershed actions suggested for the "slow improvement" goal would need to be implemented. The in-lake treatment would involve dredging the lakebed sediments instead of macrophyte harvesting. Dredging depth would need to be sufficient to remove the root zone of the aquatic plants. After dredging, periodic applications of alum could be applied to scavenge nutrients from the water column.

#### **WATER QUALITY MANAGEMENT GOAL: IMPROVE SLOWLY**

The goal of "slow improvement" in the shallow, southern lake zone is to be achieved, in part, by reducing nutrient loads from the lakebed sediments and erosion of riverbanks and lake shorelines, as

recommended by the southern lake technical advisory group (table 29). Management actions will be applied to contributing watersheds to reduce nutrient loadings from point and nonpoint sources.

The reductions in nutrient loads from lakebed sediments will be accomplished by systematic mechanical harvesting of aquatic macrophytes. The harvested biomass might be utilized for cogeneration and production of fertilizer, compost, and methanol. The design of the harvesting program will require additional data on the spatial distribution, species composition, and nutrient content of the macrophytes within the four southern lakes. Consultation with manufacturers of macrophyte harvesting equipment is strongly encouraged. An introduction to the methodology is contained in Cooke, and others (1993). Because of potentially adverse effects of macrophyte harvest on fish production and waterfowl habitat, consultation will be necessary with the Idaho Departments of Fish and Game and Parks and Recreation, and the U.S. Fish and Wildlife Service.

The reductions in nutrient loads from contributing watersheds are to be accomplished through a variety of measures (table 29) including application of BMPs to agricultural and forested lands and stormwater management. The forest practices and agriculture TAGs list numerous BMPs (tables 22 and 23) that could be implemented for the southern lake management zone. Additional guidance is also available from the Agricultural Pollution Abatement Plans for the Plummer Creek (Benewah Soil and Water Conservation District, 1990) and Lake Creek (Kootenai-Shoshone Soil Conservation District, 1991) watersheds, recently completed as part of the

state Agricultural Water Pollution Control Program. Stormwater management recommendations were addressed in detail within the development TAG (table 24). Additional reductions in nutrient loads could also be realized by upgrading wastewater treatment plants at municipal and industrial point-source dischargers and by treating the discharges from field drainage systems bordering the lower St. Joe River.

The Coeur d'Alene Tribe's reservation occupies a substantial portion of the small drainage basins that drain to the southern lake zone. The Tribe is nearing completion on two assessment reports which address point and nonpoint source pollution on tribal lands (written commun., Chris Hardy, Coeur d'Alene tribal hydrologist). The first report assesses nonpoint source pollution on the reservation and prescribes a management plan for its reduction. The second presents an evaluation of point source pollution from NPDES-permitted dischargers on the reservation.

The reduction of nutrient loads from the erosion of riverbank and lake shorelines is based largely on regulatory control of boat-induced erosion. The southern lake TAG recommended expansion and enforcement of "no wake" zones coupled with management of the number, size, and speed of boats using the southern lake area. They also recommended the installation of protective log booms. The rivers TAG listed a number of bank protection measures and permitting policies (table 30) that are applicable to the southern lake zone.

The water quality management action items recommended for the southern lake zone are designed to slowly reduce the nutrient content and biological productivity of this zone. During the initial phase of implementation, it is

likely that the dissolved oxygen deficit will continue to create violations of water quality standards. It may be advisable to artificially aerate the hypolimnion of Chatcolet Lake to maintain late summer dissolved oxygen concentrations above 6 milligrams per liter. This management technique has been extensively applied; an introduction to the methodology is contained in Cooke, and others (1993).

In order to satisfy federal water quality criteria, zinc concentrations in this zone need to be reduced, specifically, in the area north of Conkling Point. The management actions recommended for zinc reductions were previously discussed in the section on the nearshore zone.

The management actions for the shallow, southern lake zone are intended to attain, within the next decade, the desired water quality conditions for concentrations of dissolved oxygen, total phosphorus, and zinc, and clarity listed in Table 32. Table 32 compares the desired conditions to those measured during the 1991-93 lake study and any applicable legal-based standards. Current conditions for the four variables do not meet the desired conditions.

Table 32      Numeric Values for current, desired, and criteria/standards-based water-quality conditions in the shallow, **southern-lake management zone**.

	Desired Condition <sup>6</sup>	Current Condition <sup>1</sup>	Standard or Recommended Levels
Dissolved Oxygen (mg/L) <sup>2</sup>	8.4	8.4	6.0
Total P (ug/L) <sup>2</sup>	12.0	18.3 <sup>4</sup>	25.0 <sup>5</sup>
Zinc(ug/L)(ppb) <sup>2,3</sup>	32.7	39.0	32.7
Clarity (Secchi depth meters)	4.0	3.0	none

1. Average of Chatcolet and Blue Point Stations unless otherwise noted.
2. Seven day average.
3. Applies to area of southern lake north of Conkling Point.
4. Average total phosphorous = 18.3 ug/L; worst case Chatcolet Lake 26.9 ug/L.
5. Standard based on Idaho water quality standards and wastewater treatment requirements, EPA "Gold Book" criteria (as interpreted by National Toxic Rule) or phosphorus levels recommended to prohibit nuisance aquatic weed growth.
6. Based on interpretation of Idaho Antidegradation policy and special resource water designations of lake Coeur d'Alene.

## **BENEFITS OF MANAGEMENT ACTIONS FOR LOWER RIVER ZONE**

### **OVERVIEW OF WATER QUALITY ISSUES AND MANAGEMENT GOALS**

Within the lower rivers zone, water quality issues common to the lower reaches of the two rivers include:

- reduction of bank erosion,
- control of nutrient enrichment from point and nonpoint sources,
- control of excessive growth of aquatic plants, and
- reduction of bacterial contamination.

For the Coeur d'Alene River, heavy metal contamination of the riverbank sediments and water is an additional concern. The designated beneficial uses for the lower reaches include agricultural water supply, cold water biota, primary contact recreation, and secondary contact recreation. The water quality conditions measured in the lower rivers zone during the 1991-93 lake study indicate these beneficial uses are not fully supported for the Coeur d'Alene River because of metal criteria exceedences, they are fully supported for the St. Joe River. Water quality criteria for cadmium, copper, lead, and zinc are not being met in the lower reach of the Coeur d'Alene River. The drinking water standard which applies at the tap for lead also is not met in that reach.

River bank erosion has accelerated on the mainstem Coeur d'Alene River over the last two decades (Natural Resource Conservation Service, 1994a,b). Ironically, this effect

may be related in part to installation in the late 1960's of settling basins for mining and smelting wastes. By reducing the sediment load of the river, its overall sediment transport capacity was increased. The river satisfied this additional transport capacity by eroding its banks which contain previously deposited mine wastes. The effect of boat wakes also contributes significantly to river bank erosion. In 1991, as many as 1,000 boats per weekend passed an observation point downstream of the Cataldo Mission (Natural Resource Conservation Service, 1994a,b). Lake level fluctuations also play a role in bank erosion. If the lake level is reduced too rapidly, then hydrostatic pressure in the riverbanks, which were recently underwater, may be sufficiently high to slough part of the bank into the river. The alternate wetting and dewatering may also affect geochemical process within the banks and promote leaching of dissolved heavy metals into the river.

River bank erosion also is a major concern on the lower St. Joe River. The natural levee banks separating the river from Chatcolet, Round and Hidden Lakes appear to have eroded significantly and at an increasing rate in the last half century; the separation between Chatcolet and Round lakes is now nearly nonexistent when Coeur d'Alene Lake is at full pool. The detrimental effects on the levees caused by lake level fluctuations were noted as early as 1921 (Davenport, 1921). Lake level fluctuations for hydropower production and flood control have probably contributed significantly to this process by: 1) raising the water table in the channel banks so that large stabilizing vegetation (such as the once-abundant cottonwoods) could no longer survive; and 2) raising the level of Chatcolet Lake, resulting

in higher wave energy and more sustained wave action which eroded the original channel levees (personal communication, 1994, Steve Foster, Corps of Engineers).

The majority of public comments during the April 1994 public meetings favored a goal of "slow improvement" for the lower rivers zone instead of the alternative goal of "rapid improvement." The goals of "no action" and "maintain current conditions" were not legally viable because of violations of water quality criteria and standards.

If no actions were taken, then natural processes would eventually erode the contaminated river bank materials into the lake. The period of time required for such natural cleansing is unknown, but might be estimated with a sediment transport model and additional information on the amount of contaminated sediments stored in the riverbanks. Such information is being collected by the U.S. Geological Survey as part of the Coeur d'Alene Basin Natural Resource Damage Assessment.

In order to maintain current conditions some form of institutional controls may be needed. One option is to place limits on the number, size, and speed of boats allowed to use the lower reaches of the two rivers. This option would be politically volatile, but may be one of the least expensive to implement. Problem areas might be identified through field studies so that riverbank stabilization projects could be implemented. Such projects might focus on plantings of vegetation and installation of log shields to protect the banks from wave erosion.

If the goal of "rapid improvement" had been chosen, the management options would have

included streambank stabilization techniques ranging from biotechnology through riprapping. Application of these potentially costly options would require additional hydrologic and engineering studies, probably in cooperation with the Corps of Engineers. Another option would involve altering the timing and rates of lake level drawdown, but would require extensive negotiations with Washington Water Power and other parties responsible for flood control within the Columbia River Basin. Specific to the Coeur d'Alene River is the option to remove the metals contaminated riverbank sediments and replace them with clean material. This option would be very costly, but would eliminate a major source of metals contaminated sediment to the lake.

#### WATER QUALITY MANAGEMENT GOAL: IMPROVE SLOWLY

In order to meet the goal of "slow improvement" in the lower rivers zone, the rivers TAG recommended that over the next decade accelerated streambank erosion in the St. Joe be reduced by 25 percent, whereas it should be reduced by 50 percent in the Coeur d'Alene River. Attainment of these goals is to be achieved via a combination of approaches (table 30). An initial requirement is for better knowledge of the location and severity of streambank erosion in the two rivers. Based on that, stabilization projects could be designed and tested as to their efficacy and cost. Institutional support for and funding of the projects would need to be established, possibly through user fees. Public education would be used to inform boat operators of ways they could reduce their negative impacts on streambanks. An informational pamphlet would be developed to educate private landowners of streambanks

and governmental managers in proper methods of streambank stabilization.

The recently completed Natural Resource Conservation Service study of the Coeur d'Alene River Basin assessed the extent of stream bank erosion in the lower river and suggested a variety of remediation methods (Natural Resource Conservation Service, 1994a,b).

These suggestions, developed in conjunction with the U.S. Army Corps of Engineers, are summarized as follow:

- Limit power boat use on the river, this could include limits on motor horsepower, boat size, or boat speed. Provide additional boat ramps and access. Ban power boats from the river.
- Lake level management would help reduce variations and slow transitions, thereby allowing porewater pressures in streambanks to dissipate slowly to prevent spalling of streambanks.
- Watershed treatment and/or temporary storage for reduction of impacts from upstream runoff.
- Management alternatives such as vegetation plantings and livestock management on lands adjacent to the river.
- Bypass "hot spots" of metal contamination with channelization.
- Deepen channels in aggrading (depositional) areas, especially on the

North Fork, to provide a non-contaminated sediment source to cover the contaminated sediments of the main river.

- Uncontaminated soil could be used as fill material between the top of the banks and the existing bank slopes; a protective vegetative cover could then be established.
- Contaminated sediment could be removed and banks resloped and stabilized. This would depend on the amount of material involved, EPA hazardous waste regulations, and identification of suitable disposal sites.
- Construct rock bank protection from the summer water level down a minimum of five feet or below the normal winter low water level.
- Start riprap projects on highest priority areas, beginning with outside bends and trailing banks, straight sections next, and inside bends last. Priorities should also be based on the severity of contamination.
- "Do nothing" approach and try to determine how long for natural stabilization and how much volume will be removed during this process.

The knowledge gained from the Natural Resource Conservation Service's river basin study has been of great value in identifying problems and potential solutions for that river. A similar assessment of the St Joe River, including the St. Maries River, would also be of great value because the St. Joe

River is now the largest loading source of nutrients for Coeur d'Alene Lake.

## **BENEFITS OF MANAGEMENT ACTIONS FOR DEEP, OPEN WATER ZONE**

### **OVERVIEW OF WATER QUALITY ISSUES AND MANAGEMENT GOALS**

With the deep, open water zone, water quality issues include, but are not limited to:

- recovering depletion of dissolved oxygen,
- stabilizing highly-enriched heavy metals in the lakebed, and
- potential toxicity of heavy metals to aquatic biota in the lakebed and lake water.

The designated beneficial uses are domestic water supply, agricultural water supply, cold water biota, salmonid spawning, primary contact recreation, and secondary contact recreation. The water quality conditions measured in the deep, open-water zone during the 1991-93 lake study indicate these beneficial uses are not fully supported because of potential toxicity of zinc. The federal water quality criteria for cadmium, lead, and zinc are not being met because the concentrations near the lake bottom are exceeding acute and/or chronic criteria for aquatic biota. Impact to aquatic biota has been demonstrated only in the case of phytoplankton growth inhibition.

The majority of public comments during the April 1994 public meetings favored a goal of "slow improvement" for the deep, open

water zone instead of the alternative goal of "rapid improvement." The goals of "no action" and "maintain current conditions" were not legally viable because of exceedences of water quality criteria.

If no actions were taken to improve water quality, then the recent improving trend might be reversed by gradual increases in nutrient loadings from existing and new point and nonpoint sources. In order to maintain current conditions, nutrient loads to the lake would need to be held at current levels. Such an action would require "pollution trading" to balance increases and decreases in nutrient loadings.

If the goal of "rapid improvement" had been chosen, then an aggressive program of nutrient reductions would have been needed to reduce the lake's biological productivity and, hence, its hypolimnetic dissolved oxygen deficit. Such a program would have required extensive implementation of BMPs throughout the basin, substantial reductions in nutrient loadings from municipal wastewater treatment plants and nearshore septic tank systems, and adoption of ordinances to closely manage the effects of new development on nutrient loadings to the lake. The management actions available for "rapid improvement" of heavy metal contamination of the lakebed would be quite limited and very costly. The obvious solution would be to remove the contaminated lakebed sediments by dredging. However, several factors argue strongly against this action. The cost could be on the order of tens, even hundreds, of millions of dollars. A suitable disposal site (most likely for legally designated hazardous substances) would have to be located. The dredging operations would probably cloud the lake and

the Spokane River downstream for a substantial period because the lakebed sediments are very fine grained. Additionally, the lakebed porewaters contain very high concentrations of dissolved metals that would be released into the lake and the Spokane River. Dredging would not be feasible until the source of contaminated sediments, the Coeur d'Alene River, had been remediated. Instead of dredging, the lakebed might be capped with clean sediment, with an estimated cost of tens of millions of dollars. However, the underlying contaminated sediments may continue to leach dissolved heavy metals into the clean capping sediments and ultimately contaminate them. As with dredging, remediation of the source of contaminated sediments would have to be done prior to capping, also at undoubtedly tremendous cost. It is remotely possible that future technological developments may make dredging and/or capping feasible, especially if metal recovery could partially defray the costs.

#### WATER QUALITY MANAGEMENT GOAL: IMPROVE SLOWLY

The deep, open water zone integrates the water quality effects of natural and human influences from throughout the basin; therefore, the goal of "slow improvement" in the deep, open water zone is to be achieved partially with management actions prescribed for the nearshore, southern lake, and lower river zones. The majority of the lake's nutrient loading is delivered by the Coeur d'Alene and St. Joe Rivers. Therefore, management actions implemented in those two basins are important for achieving the management goal.

Control of erosion and associated nutrients within the Coeur d'Alene and St. Joe basins is a major management action for this zone. Erosion control was addressed by the TAGs for forest practices (table 22), agriculture (table 23), and development (tables 24-27). Based on a recently-completed study of erosion in the Coeur d'Alene River basin (Natural Resource Conservation Service, 1994b), forest lands accounted for about two-thirds of the sediment load delivered by the Coeur d'Alene River to the lake; sediment input from agriculture was minimal. A similar situation likely applies to the St. Joe River Basin. The primary focus of erosion control in the Coeur d'Alene and St. Joe basins should therefore be on forest practices. The largest landholder in the basin, the U.S. Forest Service, had revised its land management philosophy to one more focused on managing watersheds and ecosystems as a whole. The Idaho Department of Lands, the agency responsible for enforcement of Idaho's Forest Practices Act, has developed a cumulative effects, or watershed management, approach for inclusion in the Forest Practices Act requirements. These two recent shifts in policy have the potential to substantially reduce erosion and thereby improve the quality of runoff from forest lands.

In contrast to timber harvest, the use of BMPs for agricultural activities is voluntary. Federal agricultural policies and programs and Idaho's state Agricultural Water Quality Program have reduced water quality degradation, particularly in specific project areas such as Lake Creek (Kootenai-Shoshone Soil Conservation District, 1991) and Plummer Creek (Benewah Soil and Water Conservation District, 1990). An expansion of such projects, coupled with

increased voluntary implementation of BMPs, would reduce sediment and nutrient loadings generated from agricultural lands.

Reductions of phosphorus loadings from municipal wastewater treatment plants in the Coeur d'Alene and St. Joe basins can also reduce nutrient loadings to the deep, open water zone. The construction of the South Fork Coeur d'Alene River Sewer District's wastewater treatment plant at Page was an important contribution toward improved water quality in the lake. However, this plant still contributes as much as one-quarter of the phosphorus load delivered by the Coeur d'Alene River to the lake. The costs of upgrading the Page plant and other municipal plants would be substantial. Those costs might be shared basinwide if the benefits accrue to the lake as a whole. One inexpensive means of reducing the phosphorus content of effluent from municipal plants is to curtail the use of phosphate-bearing detergents. Phosphate detergent bans have been enacted in neighboring counties and states and may have already reduced the availability of such detergents in the Coeur d'Alene Lake area. However, commercial and institutional detergents are exempt from such bans; further reductions in wastewater phosphorus loads could be achieved by encouraging the use of phosphate-free products in these sectors.

The foregoing management actions are designed to reduce nutrient concentrations and, hence, biological production in the deep, open water zone. These actions should reduce the lake's hypolimnetic dissolved oxygen deficit and, offer the most reasonable course of action for preventing the release of trace elements and nutrients out of the

lakebed sediments into the overlying water column. This zone also suffers from water column concentrations of zinc that exceed federal water quality criteria. The reduction of zinc concentrations will be largely dependent on reducing zinc loadings from the Coeur d'Alene River basin. Management actions recommended by the rivers technical advisory group are geared to reduce erosion of zinc-bearing sediments in the lower reaches of the Coeur d'Alene River. Zinc loadings to the lake are also likely to be reduced by remediation activities underway or planned by the Bunker Hill Superfund Site cleanup and by the Coeur d'Alene Basin Restoration Project.

The management actions for the deep, open water zone are intended to attain, within the next decade, the desired water quality conditions for concentrations of dissolved oxygen, total phosphorus, and zinc, clarity, and coliform bacteria counts listed in Table 33. Table 33 compares the desired conditions to those measured during the 1991-93 lake study and any applicable legal-based standards. Zinc concentrations currently exceed the desired condition by a factor of 7.8. The current condition for dissolved oxygen and phosphorus concentrations as well as clarity have already attained the desired conditions; however, Idaho water quality standards for dissolved oxygen do not apply to the lower hypolimnion of lakes with depths greater than 35 meters.

Future improvements in water quality in the deep, open water zone might be more readily achieved if water quality management was coordinated by a lake basin commission. Because water quality improvements would likely occur cumulatively in small

Table 33      Numeric Values for current, desired, and criteria/standards-based water-quality conditions in the deep, **open-water management zone**.

	Desired Condition <sup>9</sup>	Current Condition <sup>1</sup>	Standard or Recommended Level <sup>8</sup>
Dissolved Oxygen (mg/L) <sup>2</sup>	7.0	7.0	6.0 <sup>3</sup>
Total P (ug/L)(ppb) <sup>2</sup>	9.0	9.0	25.0
Zinc(ug/L)(ppb) <sup>2</sup>	32.7	143	32.7
Clarity (Secchi <sup>2</sup> depth meters)	6.0	6.0 <sup>4</sup>	none
Coliform bacteria	500/100 ml	-	500/100 ml <sup>5</sup>
	200/100 ml	-	200/100 ml <sup>6</sup>
	50/100 ml	-	50/100 ml <sup>7</sup>

1. Average of values of Tubbs Hill, Wolf Lodge, Driftwood and University Point Stations.
2. Seven day average.
3. Standard applies to all waters except the lowest 7 meters of the water column at depths greater than 35 meters.
4. Worst case during winter runoff at University Point, Station 1.0 meters.
5. At any time.
6. In no more than 10% of the samples taken over a 30 day period.
7. Geometric mean of samples taken over a 30 day period.
8. Standard based on Idaho water quality standards and waste water treatment requirements EPA "Gold Book" criteria (as interpreted by National Toxic Rule) or phosphorus levels recommended to prohibit nuisance aquatic weed growth.
9. Based on interpretation of Idaho Antidegradation policy and special resource water designation of lake Coeur d'Alene.

increments, the lake basin commission would provide coordinated management at the lake basin level. One important function that could be implemented and coordinated by a lake basin commission is an intensive public information and education program, which is a management action recommended by the TAGs for agriculture and development. Another important function would be to facilitate communication among the numerous entities that will be involved in planning and implementing management actions throughout the lake's drainage basin. For example, the Coeur d'Alene Tribe has recently developed specific management plans for control of point and nonpoint source pollution on their reservation. Such plans, and others, need to be integrated into an overall, basin wide approach to management of Coeur d'Alene Lake. The early stages necessary for the formation of a lake basin commission for the Coeur d'Alene basin have already occurred. Since the late 1980's, representatives of governmental agencies and public and private interest groups with responsibilities or interests in the basin have met regularly as the Coeur d'Alene Basin Interagency Group (CBIG). CBIG has served as a useful forum for informal discussion and coordination of basin wide issues and activities. CBIG could form the nucleus of a more formal approach to water quality management for the basin. The Coeur d'Alene Basin Restoration Project (CBRP) was recently formed by Idaho Division of Environmental Quality and the U.S. Environmental Protection Agency. Management of CBRP is shared by the two founding agencies and the Coeur d'Alene Tribe. At present, much of CBRP's focus is on restoration of areas in the South Fork Coeur d'Alene River damaged by mining activities. The activities of CBIG have

recently been integrated with CBRP. Thus, the lake management plan for Coeur d'Alene Lake has become an important component of CBRP.

## ENVIRONMENTAL EVALUATION

One potential source of funding to help implement this lake management plan is the U.S. Environmental Protection Agency's Clean Lakes Program. In order to qualify for this funding, a project must evaluate the potential for environmental impacts that may be caused by the project's management actions. Responses to the required questions for the environmental evaluation are listed as follows:

1. Will the proposed project displace any people? No.
- 2a. Will the proposed project deface existing residences or residential areas? No.
- 2b. What mitigative actions such as landscaping, screening, or buffer zones have been considered? Not applicable.
- 2c. Are they included? Not applicable.
- 3a. Will the proposed project be likely to lead to a change in established land use patterns, such as increased development pressure near the lake? Yes, the growth rate of nearshore development is likely to decrease.
- 3b. To what extent and how will this change be controlled through land use planning, zoning, or through other methods?

The majority of the decrease in growth rate will be implemented under Kootenai County's comprehensive plan.

4. Will the proposed project adversely affect a significant amount of prime agricultural land or agricultural operations on such land? Yes, voluntary implementation of BMPs

will modify agricultural operations to some extent.

5. Will the proposed project result in a significant adverse effect on parkland, other public land, or lands of recognized scenic value? No.
- 6a. Has the State Historical Society or State Historical Preservation Officer been contacted? Not applicable.
- 6b. Has he responded, and if so, what was the nature of that response? Not applicable.
- 6c. Will the proposed project result in a significant adverse effect on lands or structures of historic, architectural, archaeological, or cultural value? No.
7. Will the proposed project lead to a significant long-range increase in energy demands? No.
- 8a. Will the proposed project result in significant and long-range adverse changes in ambient air quality or noise levels? No.
- 8b. Short term? No.
- 9a. If the proposed project involves the use of in-lake chemical treatment, what long and short term adverse effects can be expected from that treatment? Not applicable. 9.b. How will the project recipient mitigate these effects? Not applicable.
10. a. Does the proposal contain all the information the EPA requires in order to determine whether the project complies with Executive Order 11988 on floodplains? Yes.
- 10.b. Is the proposed project located in a floodplain? Yes, the lower rivers management zone includes the floodplains of the Coeur d'Alene and St. Joe Rivers.
- 10.c. If so, will the project involve construction of structures in the

- floodplain? Yes, if riprap is installed on riverbanks.
- 10d. What steps will be taken to reduce the possible effects of flood damage to the project?  
Riprap will be designed in consultation with the U.S. Army Corps of Engineers to minimize the potential for flood damage.
- 11a. If the project involves physically modifying the lake shore or its bed or its watershed, by dredging, for example, what steps will be taken to minimize any immediate and long term adverse effects of such activities? Not applicable.
- 11b. When dredging is employed, where will the dredged material be deposited, what can be expected, and what measures will the recipient employ to minimize any significant adverse impacts from its deposition? Not applicable.
- 12a. Does the project proposal contain all information that EPA requires in order to determine whether the project complies with Executive Order 11990 on wetlands? Yes.
- 12b. Will the proposed project have a significant adverse effect on fish and wildlife, or on wetlands, or any other wildlife habitat, especially those of endangered species? Yes, the harvesting of aquatic macrophytes in the southern lake zone and/or selected bays would remove fishery habitat and food sources for waterfowl. Endangered species habitat would not be significantly affected.
- 12c. How significant is this impact in relation to the local or regional critical habitat needs? Not significant.
- 12d. Have actions to mitigate habitat destruction been incorporated into the project? Yes, aquatic macrophyte harvesting would be designed in consultation with Idaho Department of Fish and Game and U.S. Fish and Wildlife Service.
- 12e. Has the recipient properly consulted with appropriate state and federal fish, game, and wildlife agencies and with the U.S. Fish and Wildlife Service? Planned, refer to 12d.
- 12f. What were their replies? Not applicable.
13. Describe any feasible alternatives to the proposed project in terms of environmental impacts, commitment of resources, public interest, and costs and why they were not proposed. Such information was discussed for each lake management zone under the sections entitled "Overview of water quality issues and management goals."
14. Describe other measures not discussed previously that are necessary to mitigate adverse environmental impacts resulting from the implementation of the proposed project. None.